MDTF:
A Most Dependent Transactions First Priority Assignment Heuristic

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INTRODUCTION

In recent years, considering the ever-growing challenging and complex requirements of target users, several advanced real-time based applications are developed by utilizing the database framework and scheduling aspects of time-constrained databases (Shanker, Misra, & Sarje, 2006a). The transaction processing techniques were first studied from the real-time perspective in real time database system (RTDBS). The RTDBS is simply a database system which works up on real time transaction (RTT).

The RTTs are associated with deadlines. They may be categorized as soft, firm and hard based on the consequences of their deadline misses. The soft RTT's deadline miss means the result will have lesser value (positive but diminishing); the firm RTT's deadline miss means the result will have no value (zero value), and the hard RTT's deadline miss means the result may be catastrophic (negative value). Therefore, the soft/firm/ hard RTTs must be completed without missing their deadline to make sure the meeting of the objectives of executing it. This discussion makes one point very much clear that deadline computation of RTTs (priority assignment of RTTs) should be performed in a customized fashion considering the nature of the application to get the best possible outcome.

Several protocols were developed to improve overall RTDBS performance. Then, it is realized that most of the real-life problems related to the database are distributed in nature. For instance, a balance transfer transaction between users of two different banks. To incorporate all these requirements, a more advanced research area called distributed real time database system (DRTDBS) is evolved. The DRTDBS may be defined as a collection of a finite number of time-constrained distributed database systems (Pandey & Shanker, 2016) (Pandey & Shanker, 2018c) connected through a network. In DRTDBS, a distributed RTT is generated at the parent site. The coordinator of this transaction is then tasked to coordinate and perform changes at multiple sites atomically. In contrary to the traditional databases, the correctness of the result in DRTDBS based application depends on two things: logical computation performed, and the time when the result is produced & disseminated. Although the result produced is functionally right, it may lead to tragic repercussions, be unusable, or has less value if it is not produced in time (Shanker, Misra, & Sarje, 2001). To make it easy for understanding, a complete list of acronyms with their meaning is presented below in Table 1.

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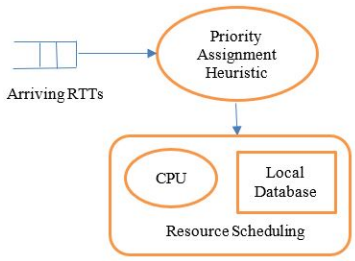
Table 1. Table of Acronyms

Acronym	Meaning
RTDBS	Real Time Database System
RTT	Real Time Transaction
DRTDBS	Distributed Real Time Database System
RTS	Real Time System
EDF	Earliest Deadline First
AED	Adaptive Earliest Deadline
AEVD	Adaptive Earliest Virtual Deadline
AAP	Adaptive Access Parameter
UD	Ultimate Deadline
ED	Effective Deadline
EQS	Equal Slack
SS	Slack-time Slice
EQF	Equal Flexibility
PSS	Proportional Slack-time Slice
NL	Number of Locks
MNL	Modified Number of Locks
MDTF	Most Dependent Transactions First

The role of priority heuristic is vital in time-constrained databases from the transaction scheduling perspective. The same can be easily understood with the help of Figure 1 which gives an abstract view of the logical transactional environment at site S.

Figure 1. Role of Priority Assignment Heuristic in RTT Scheduling



The primarily focused task in DRTDBS is to reduce transaction miss percentage. This may be done by ensuring the efficient scheduling of concurrently executing transactions (global and local). The success of transaction scheduling algorithms largely depends on the method employed to assign priorities of transactions. The concurrency control protocol and the priority assignment heuristic both have their collective and dependent responsibility of appropriately scheduling system resources mainly data items and CPU. In distributed RTT processing systems, the priority heuristic has a very close interaction with concurrency control schemes. The concurrency control protocols are widely researched topics while